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1 Introduction

1.1 Executive Summary

This document, "DESHL v4.2", is deliverable D-JRA7-3.14 from Task T3.13 "Design and implementation of DESHL v4.2" in Work Package 3 of DEISA JRA7 [1]. This document reports on the release of version 4.2 of the DESHL.

DESHL v4.1-RC2 was released at the end of August 2007. This has been deployed and tested at various DEISA sites and feedback received, particularly IDRIS and CSC. Additional feedback was received from users using the DESHL to submit production jobs to the UK's HPCx national supercomputing facility. On the basis of this feedback, the primary emphasis for the DESHL v4.2 release has been to improve the ease of installation of the DESHL and to improve user documentation.

1.2 Document Structure

Section 1 of this document contains the executive summary, references, table of acronyms, etc. while section 2 provides a brief overview of the DESHL. Section 3 describes the scope of DESHL v4.2 and indicates where the DESHL software can be obtained from. Section 4 highlights the major changes since v4.1. Section 5 itemises the issues that have been fixed since v4.1. Finally section 6 lists the known issues with DESHL v.4.2 at the time of writing.

1.3 References and Applicable Documents

[1] DEISA Annex I – "Description of Work", November 5th 2003.

[2] "JRA7 Quality Plan v4.0", DEISA JRA7 Report, Deliverable ID DEISA-JRA7-1.4, May 2007.

[3] UNICORE, http://unicore.sourceforge.net.

[4] Open Grid Forum (OGF) Simple API for Grid Applications Core Working Group (SAGA-CORE-WG), http://www.ogf.org/gf/group_info/view.php?group=saga-core-wg

[5] Open Grid Forum (OGF) Simple API for Grid Applications Research Group (SAGA-RG), http://www.ogf.org/gf/group_info/view.php?group=saga-rg

[6] ARCON Client Library, http://sourceforge.net/project/showfiles.php?group_id=102081&package_id=127938

[7] DEISA JRA7 development web site, http://forge.nesc.ac.uk/projects/deisa-jra7/

[8] "Installation and User Manual for DESHL 4.2" (This document is not a DEISA EU deliverable but is available under Docs at [7]. The DESHL v4.2 software release can also be downloaded from [7].)

[9] "Final design for DESHL v4.1" (This document is not a DEISA EU deliverable but is available under Docs at [7]. The DESHL v4.1 software release can also be downloaded from [7].)

[10] GridFTP, http://www.globus.org/grid_software/data/gridftp.php

[11] 'DESHL v4.0", DEISA JRA7 Public Report, Deliverable ID DEISA-JRA7-3.12, November 14th 2006.

1.4 Document Amendment Procedure

The document procedure is covered in the JRA7 Quality Plan [2].

1.5 List of Acronyms and Abbreviations

API	Application Programming Interface
CA	Certification Authority
CINECA	Consorzio Interuniversitario per la gestione del Centro di Calcolo Elettronico dell'Italia Nordorientale, Casalecchio di Reno, Italy
CSC	CSC – Scientific Computing Ltd, Finnish IT Center for Science
CLT	Command Line Tool
DECI	DEISA Extreme Computing Initiative
DEISA	Distributed European Infrastructure for Supercomputing Applications
DESHL	DEISA Services for the Heterogeneous management Layer
FZJ	Forschungzentrum Juelich, Germany
GUI	Graphical User Interface
HPC	High Performance Computing
IDRIS	Institut du Developpement et des Ressources en Informatique Scientifique, France
JRA	DEISA Joint Research Activity
JRA7	DEISA Seventh Joint Research Activity
JSDL	Job Submission Description Language – OGF standard
LRZ	Leibniz-Rechenzentrum München Germany
NJS	Network Job Supervisor
OGF	Open Grid Forum
SA3	DEISA 3rd Service Activity – Resource Management
SA4	DEISA 4th Service Activity – User Support
SAGA	Simple API for Grid Applications – OGF standard
SAGA-CORE-WG	Open Grid Forum SAGA Core API Working Group
SAGA-RG	Open Grid Forum SAGA Research Group
TSI	Target System Interface
UNICORE	Uniform Interface to Computing Resources

2 Overview of DESHL

The DESHL (**DE**ISA **S**ervices for the **H**eterogeneous management **L**ayer) has been developed by the DEISA Joint Research Activity JRA7 [1]. It provides standards-based access for users and their applications to manage jobs and transfer files in the DEISA heterogeneous supercomputing infrastructure. In the extended

heterogeneous DEISA infrastructure, sites have different HPC resources but all sites provide access to those resources via UNICORE [3].

This latest DESHL release, v4.2, continues to contain the DESHL client, implemented as a layered stack with a SAGA-inspired API ([4], [5]) at the top and the UNICORE ARCON client [6] at its base. The DESHL client can be used for data staging operations to, from and within the DEISA environment, and to submit, monitor and terminate jobs running on DEISA resources. Issuing a certificate for access to a DEISA site is the task of the certificate authority associated with the user's national location. These certificates are then held locally, and the DESHL client is configured via a single configuration file to allow seamless access to all such configured sites.

The DESHL v4.2 release and its supporting documentation are publicly available and can be downloaded from the DEISA JRA7 development site at [7]. The supporting documentation includes this document as well as the Installation/User Manual [8] and the design document [9].

At the time of writing this document, this release of DESHL v4.2 is publicly available from the DEISA JRA7 NeSCForge development site at [7]. The release is contained in an executable jar that can be run as a GUI installer or from the command line. It can be found under the DEISA JRA7 '*Files*' tab. The instructions for running the installer can be found at the same site. The Installation/User manual [8] can be found under the '*Docs*' tab.

3 Scope of DESHL v4.2

DESHL v4.1-RC2 was released as a non-EU deliverable at the end of August 2007. This contained fixes for a number of major bugs, included several new features and underwent significant system testing prior to release. This release underwent further system testing at IDRIS and CSC and is being used in production by DEISA users.

As a result of this, the scope for DESHL v4.2 has been driven by feedback from users, DESHL training courses, the DEISA JRA2 research activity, consultations with the DEISA SA3 resource management activity, the DEISA SA4 user support activity and the DEISA executive. The general view of all was that consolidation of the existing software in terms of bug fixes was of more importance than the addition of further functionality. In addition, production users from the DEISA Extreme Computing Initiative (DECI) requested specific improvements to the user documentation.

As result of the feedback received, the following specific items were investigated and considered for inclusion in DESHL 4.2.

3.1 Supplying an email address for notification when a submitted job changes its state.

The feature to supply an email address for notification was considered a high priority. This is because the batch scheduler at LRZ requires a valid email address to be associated with a submitted job, and it is not possible to set this using DESHL. On investigation by JRA7, it was discovered that while SAGA defines a JobContact attribute for this purpose there is currently no equivalent in the JSDL specification. As DESHL maps from SAGA attributes to JSDL attributes during its construction of a job, the lack of this attribute in JSDL means that it is not possible to pass this information in a standards-compliant fashion. The issue was therefore resolved by a local change to the TSI at LRZ rather than a change in the DESHL itself. JRA7 also notified the UNICORE development team that is possible to pass the email field in

UNICORE5 but not in UNICORE6, and that LRZ were relying on this behaviour. This is recorded in a UNICORE6 Feature Request.

3.2 Improving the installer to make it more automated and user-friendly.

Following feedback from the DEISA sites that tested DESHL v4.1-RC2, and particularly from production users, it became clear that installation could still be problematic. Specifically, users were required to know the gateway address for their home site and the list of NJS names accessible at that site. It was however not possible to include this information in the DESHL user manual, as this is subject to change. On the basis of this feedback, it was decided to address these issues by developing a new installer which dynamically obtains configuration details from the DEISA infrastructure at installation time.

3.3 DESHL user documentation

While the DESHL user manual is regarded as highly informative, it has been reported as being confusing to some first-time users. As these issues could potentially dissuade a new user from installing the DESHL client, it was decided to treat these as high priority and so rework the user manual to allow first-time users to more easily understand how to use the DESHL client.

3.4 Support wildcards to make staging out of data from USPACE easier

Currently files to be staged out after a submitted job has completed, need to be explicitly named in SAGA_FileTransfer directives. This has been reported as causing problems in some circumstances, such as when jobs produce restart files whose names cannot be known in advance. At such times it would be useful to be able to specify that all contents of the USPACE be copied out at the end of the job rather than explicitly naming the files. After some investigation ite became clear that a workaround is already available in the form of making a tarball of the contents of the USPACE as the final step in the submitted job and staging out the tarball file. Additionally, this problem can be avoided if output files are written to explicit locations outside of the USPACE, such as $DEISA_HOME, and therefore do not require to be staged from the USPACE. For these reasons, it was decided not to address this further in DESHL v4.2.

3.5 Make the use of file naming conventions more consistent.

Currently DESHL uses different conventions for locating jobs, specifying data staging for jobs and locating remote files. This needs to be made consistent to allow easier use. Whilst this is a high priority task, it has significant implications for testing, user interfaces and documentation. It was therefore not possible to take this further in the timescales available for DESHL v4.2. Instead, investigations into this will continue and so it is expected to be addressed in a future release.

3.6 Using DESHL via DEISA Modules

An investigation into how best to include the DESHL client in the DEISA Common Production Environment via DEISA module files was undertaken in response to a direct request from DEISA SA3 at the September 10th 2007 SA3 videoconference. This has resulted in appropriate changes in DESHL v4.2.

4 Major Changes in v4.2

This section describes the major changes in DESHL v4.2.

4.1 Improved installer

Feedback from production users who installed DESHL v4.1 indicated that it was not obvious which values should be entered during the installation procedure. As a result of this, users required more support than was expected to be able to successfully run jobs at DEISA sites. To alleviate this, the installer has been substantially rewritten for v4.2 and now requires very limited information input from the user. The installer now reads from a file containing a list of gateways, in the same format as used by the UNICORE GUI client. The user selects their home gateway from this list, and the set of execution sites and suggested shortcut names is built by querying the selected gateway. After installation, the user is still able to edit the configuration file as required.

4.2 Improved documentation

Based on feedback from users who installed DESHL v4.1, the user manual was deemed to be overwhelming and confusing, and a number of errors were reported. In response, the user manual has been reorganised for this release and the errors corrected.

4.3 DEISA "modules" installer

Including the DESHL in the DEISA common production environment requires a central installation of the DESHL client at each DEISA site. This is instead of the per-user installation which is currently the norm for the DESHL client. Following an investigation a number of code changes have been made to better support the use of the DESHL client from a central installation. As such, the DEISA JRA7 DESHL development team can now build on request a DESHL installer that will allow a systems administrator at a DEISA site to install a central DESHL instance.

5 Fixed Issues

The following issues from the DEISA JRA7 project [7] tracker have been fixed in DESHL v4.2 since the v4.1 release report [11].

5.1 Feature requests provided in v4.2

These are the feature requests that have been integrated into the v4.2 release.

183 How do I find out the name of a particular UNICORE site

The list of gateways is now read from a configuration file, and the list of sites available from a selected gateway is generated by querying the gateway.

246 Alternative configuration via gateways.xml

This is now used by the DESHL installer to generate the contents of the DESHL configuration file.

369 Provide a list of all DEISA gateways in the GUI

This feature has been implemented.

370 Inclusion of the DESHL in the DEISA primer

Relevant material is included in the DEISA primer.

442 Is it possible to obtain the NJS names of the DEISA sites

This is now done automatically by the GUI installer.

465 Difficulties diagnosing errors - storage

Error reporting has been improved significantly since this was originally reported.

466 Difficulties diagnosing errors - disk space

Error reporting has been improved significantly since this was originally reported.

468 Difficulties diagnosing errors - site name

Error reporting has been improved significantly since this was originally reported.

479 DESHL is not mentioned in the DEISA primer

Relevant material is included in the DEISA primer.

1099 Installer issues

These issues have been resolved in the new version of the GUI installer.

1100 UNIX compliance

Command aliases have been implemented for those commands which have common UNIX equivalents.

5.2 Bugs closed in 4.2

These are the bugs that have been closed for the DESHL v4.2 release.

266 Move - Null Pointer Exception

Error reporting has been improved dramatically since this was originally reported.

439 File copies between SARA and CINECA

DEISA HOME fix has resolved this.

440 Problem with relative/absolute path when submitting the chmod.sh job.

This is no longer relevant since execute permissions are set when a file is transferred.

442 Is it possible to obtain the NJS names of the Deisa sites?

This has been fixed.

470 helloworld job

This example has now been removed from the documentation.

475 move failure at CINECA

This has been fixed.

476 Remove failure at CINECA

This has been fixed.

758 submit long option not implemented?

The long option will no longer be implemented.

1118 Client-server fails when multiple aliases for localhost

This has been fixed. A patch was successfully tested at IDRIS, where the bug was originally reported.

1037 DESHL list with -s

This option is no longer available and the documentation has been updated to reflect this.

1145 DESHL fails if shortcuts not present

This has been fixed.

1217 Fetch fails silently

This has been fixed.

1242 Server and client have different working directories

This has been fixed.

6 Known Issues

At the time of writing, the following are outstanding bugs and Feature Requests. An up to date list can be found at the DEISA JRA7 NeSCForge development site at [7].

Note that a number of the user-prompted feature requests are concerned with variations on finding out the name of a particular UNICORE vsite. This functionality is currently being investigated with a view to its inclusion in the DESHL in the very near future.

6.1 Feature Requests

148 JVM start-up overhead for each DESHL CLT command invocation

While the latest release separates the DESHL into a client and server, the client is still implemented in Java and requires a JVM start up for each command.

158 Directory Export

Export of directories from DESHL to local storage is not currently supported. However, export of individual files is supported.

247 Access via default home site

Allow the user to nominate a default site to be used if a site is not specified in a command.

263 Wildcards

Allow wildcards in file paths.

371 Existence of Config.csv file or problem with permissions

DESHL error reporting does not distinguish between the config.csv file being missing and the situation where this file has the wrong access permissions.

387 Consistency of references to file in JSDL files and SAGA scripts

File naming convention is different for job submission staging files and those used with data staging commands.

393 Use of DEISA HOME and DEISA_DATA for core and non-core users

The DESHL documentation needs to be updated to explain the differences in the use of DEISA_HOME and DATA by core non-core DEISA users.

395 Get a list of all vsites connected to a single UNICORE gateway

In DESHL v4.2 the list of vsites is available on installation of the DESHL. However, vsite availability may subsequently change so it would be useful to update this information during any subsequent DESHL sessions.

435 Data staging sanity check

In the JSDL input facility it would be useful if a check could be made on the names of the files to be staged to ensure they exist before the operation is activated.

449 Is it really necessary that the command names (isDir, isFile, …) are case sensitive.

Currently the DESHL commands are case sensitive. It would be useful if this were not the case.

452 Job submission function issues - more steps needed compared to UNICORE GUI

The UNICORE GUI does not require the user to go through as many stages when executing a job.

453 Job identifiers and scripting - should id be returned as a result and not printed?

On a successful job submission, the job identifier is printed to the console. To support scripting this should be returned as a result.

455 Status must return well defined return code

To support scripting Status must return a well-defined return code

456 Fetch improvements

A number of further options should be added to the Fetch command.

457 Jobs - how to tell which are submitted by DESHL

It is not possible to tell which jobs have been submitted by DESHL and which by the UNICORE GUI.

471 Use of JRA7 in internal names

Should the term JRA7 be used in the DESHL internal names.

478 DESHL needs to accessible from the DEISA web site at www.deisa.org

There are links from www.deisa.org to the DESHL development site but are these sufficient.

480 A statement on DESHL support is needed.

The DESHL documentation needs to state how user support can be obtained in the long term.

484 A config.csv which contains all possible resources via all DEISA gateways

Supplying this with the installation may be helpful for testing purposes.

524 Links to DESHL need to made more prominent on www.deisa.org

The existing DESHL links are from the DEISA JRA7 pages and so are embedded quite far into the DEISA web site and hence are not very prominent.

526 DESHL for dummies

Some users have said that a very basic guide on the DESHL would be useful.

527 Job ids are too long.

Some users say that the unique job ids are too long even with short-cuts.

531 More readable job ids

Job reference strings should be something more readable like “hostname.user.id”.

532 Debugging with DESHL is difficult

Advanced debugging when a job submission fails need to be done through Unicore.

544 SAGA now has a different take on job states

DESHL Job states need to be updated to comply with the latest SAGA definitions. (This work has been largely completed; however DESHL does not

currently make use of the “New” job state, jobs are created as Running or Queued by submitting a job specification to the remote system.)

1096 Contact email for jobs sent LRZ

Jobs submitted to LRZ in Germany need to have a contact email specified. This is not supported in DESHL. This has been fixed with a local TSI change but there is a further issue concerning contact emails, the DESHL, SAGA and JSDL (see section 3.1 for further explanation).

1097 The JSDL2AJO converter needs to be kept in sync with the community version

This converter is used internally by the DESHL.

1101 GridFTP issues

The prototype GridFTP integrations needs improving if it is to be used in production.

1102 Hard-coded paths in DESHL scripts

The many DESHL scripts are hard-coded with paths etc at install time, and are thus not portable even across different UNIX machines connected to the same file space.

1103 Authentication only when needed

Currently, the DESHL client requires one to enter all passwords to all registered certificates before even giving "deshl version" response.

1105 Performance Testing

This would be useful.

1106 "pass through" feature for machine-specific directives

Consider possible implementation of a "pass through" for the specification of machine specific scheduler directives.

1107 Change format for shortcut names

A different shortcut style may be helpful when addressing remote servers.

1117 Use of DESHL via modules

Some progress has been made with this but further work would be helpful.

1243 disable hostname check

It might be useful to have an override flag to disable the check,

1294 copy-paste avoiding for Job Id

Given that Job Ids are long, then an job id stored as an environment variable feature may be helpful,

6.2 Bugs

226 When copying to full disks, on error stray jobs left

This needs to be fixed in Roctopus.

236 Can not recursively copy a directory from a DEISA machine to a local disk.

This appears to be an Arcon [6] issue and occurs with move as well, the functionality to request such an action is therefore currently disabled.

237 Can not overwrite a local file during an overwrite copy from a DEISA machine

DESHL should print an appropriate error message until this is fixed.

255 TestSubmitJobUsecase Unavailable Software fails

The system test for unavailable software in TestSubmitJobUsecase fails because it doesn't check the output of the job to see that the unavailable software could not be run.

256 Installer Bugs

There are useability issues with certain window managers and JVM combinations. The installer can be used from the command line if necessary.

The 'Test Connection' button has been removed.

271 Listing extended job stats causes stdout output

When this is requested, the stout and stderr for the jobs are erroneously retrieved to the outcome directory even though they were not requested.

359 Invalid SAGA job definition

It is possible for the user to create an invalid job definition by omitting required SAGA directives or giving bad values.

377 Directory copy between sites throws exception if no file present in directory

Directories cannot be copied between sites.

392 Queued executing sub jobs appear with GUI but not for main job

Once a job has been submitted from the DESHL it is not possible to distinguish if it is in a pending queue or if it is actually executing. This is an ARCON Client [6] issue and cannot be rectified.

394 Client hangs when TSI is unavailable

If the TSI at a remote site is unavailable then a command will hang until the remote TSI is restarted.

433 Copy on a remote site hangs

Copy with an NEC Unicore site hangs. This may be the DEISA_HOME issue again.

436 SAGA Hostlist needs full gateway address

The full gateway address must be included.

438 Job submission at SARA

Whilst job submission at SARA now works further investigation is required to understand possible installation issues with the UNICORE ssh plugin.

444 On line help should match written documentation

The on-line help text should be identical to the written documentation.

451 Job submission syntax issues

Naming conventions, use #ROOT and capitalisation need to be consistent and clarified.

461 Intermittent problem with fork

DESHL error logs reported that fork was unavailable. This appeared once for a user and they were unable to replicate it.

463 Wrong time with -f on status or jobs

Occasionally the wrong time is displayed in job status.

469 Documentation Issues from Denis Girou

Many of the issues have been dealt with in [8] but a number are still outstanding.

493 GridFTP - Globus proxy created with loose permissions

For the DESHL GridFTP[10] functionality There is no way in Java to protect the Globus proxy with appropriate permissions.

494 GridFTP - Requires unlimited strength encryption

Documentation needs to be clear about how to deal with this.

495 GridFTP - Requires naming convention for CA certificates.

The Certification Authority certificates must be named using their hash for them to be acceptable to the Globus library.

497 GridFTP - Can suffer from clock skew

If the clock on the user machine is faster than that of the GridFTP server then the user's proxy will get rejected.

498 GridFTP - Proxy generation configuration hard coded

The configuration for generating a proxy is currently hard-coded in the DESHL.

499 GridFTP - only supports basic file transfer functionality

The current DESHL gridftp only supports basic file transfer capabilities.

500 Keystore code duplicated

There is no duplicate code in the DESHL for dealing with keystores. This could be refactored.

508 Delay in job status being updated following terminate

Following a job termination, the job status can take some time to reflect this.

530 Move treating a file as a directory and failing

This appears to working ok. Further investigation required.

543 GridFTP - must name upload file, can't just give parent directory.

A clearer description in the user documentation is needed.

1036 install.xml template.

Template is missing.

1104 Copy fails under stress testing.

Stress testing with 100's of files produces failures. This requires further investigation.

1276 Relative paths not suitable in configuration file

The use of relative paths in the DESHL configuration file may be unreliable due to where the DESHL server thinks its working directory is. The examples in the manual should be changed to explicitly use absolute paths.

1300 Typos in the NJS name during install

If you make a typo in the file for the NJS name it's not simple to adjust it without doing a reinstall.

1303 documentation: job submission issues

Better terminology for files at different sites would be helpful.